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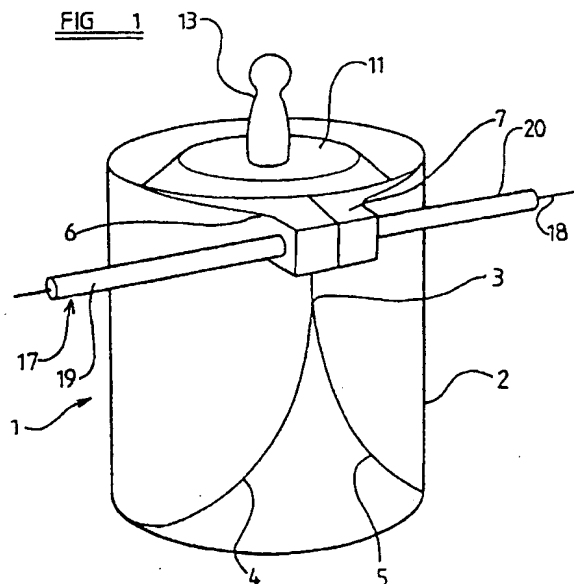
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GB 2344080 A EP 0967128 A2

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(54) Abstract Title  
Impact responsive means for raising a vehicle bonnet

(57) A safety device for lifting part of the hood or bonnet of a motor vehicle includes a rupturable housing 2, sealingly enclosing an inflatable sleeve (10 Fig 2). The housing is adapted to rupture on inflation of the sleeve to permit the sleeve to emerge from the housing. In one embodiment the housing has two projecting lugs 6,7 defining apertures. Preferably the core 18 of a cable 17 passes through the apertures and the outer sleeves 19,20 of the cable engages the exterior parts of the lugs. Conveniently on inflation of the sleeve (10, Fig 2) the lugs move apart applying tension to the core of the cable, and cause a catch (29, Fig 6) to rotate and release a portion (40, Fig 5) of a hinge arm which prevents excess upward movement of the hood or bonnet. Preferably the inflatable sleeve 10 is formed of fabric and the housing 2 is formed of a plastic material.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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FIG 1

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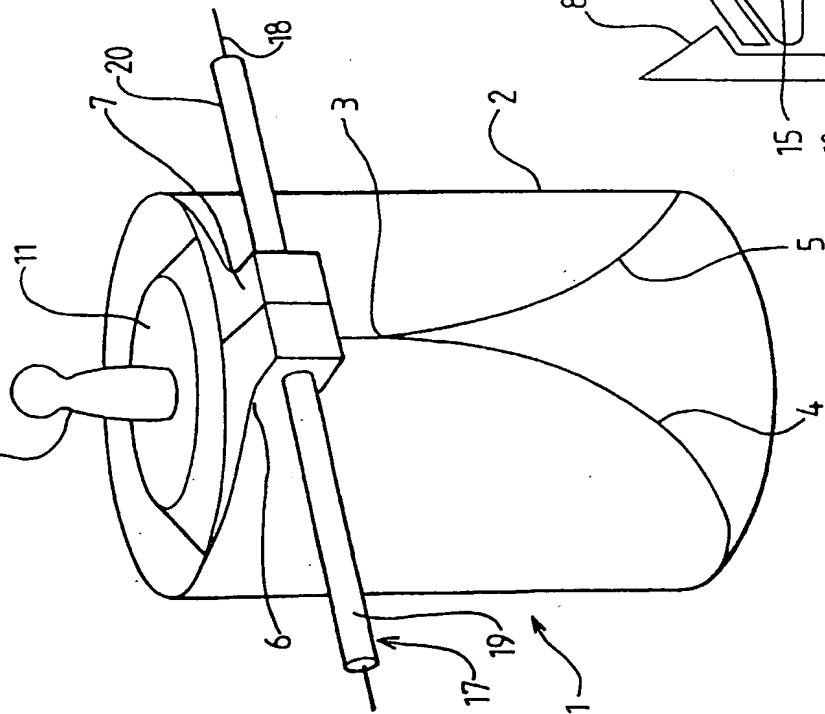
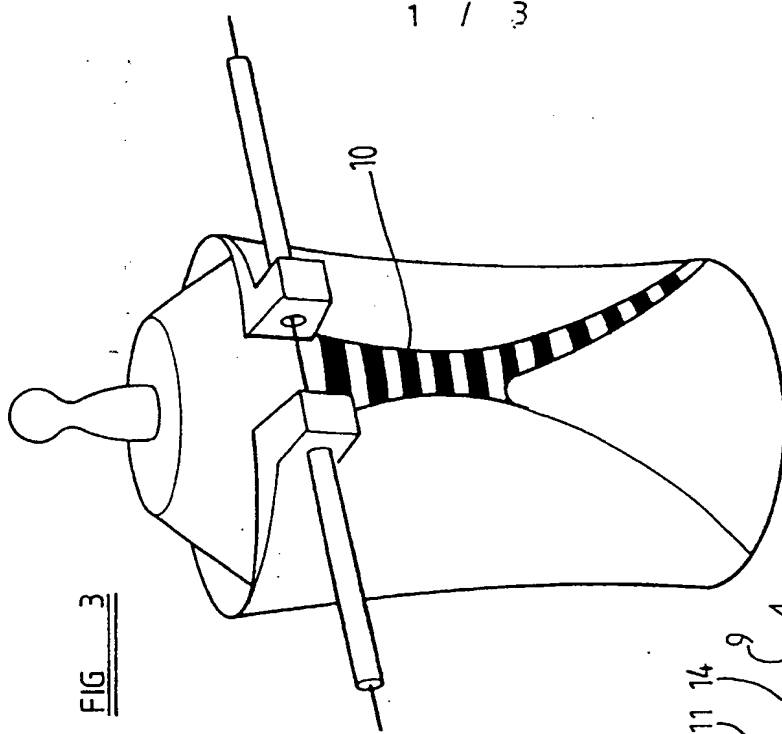
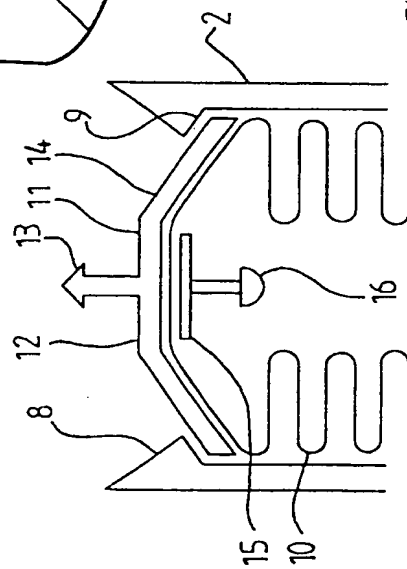


FIG 3



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FIG 2



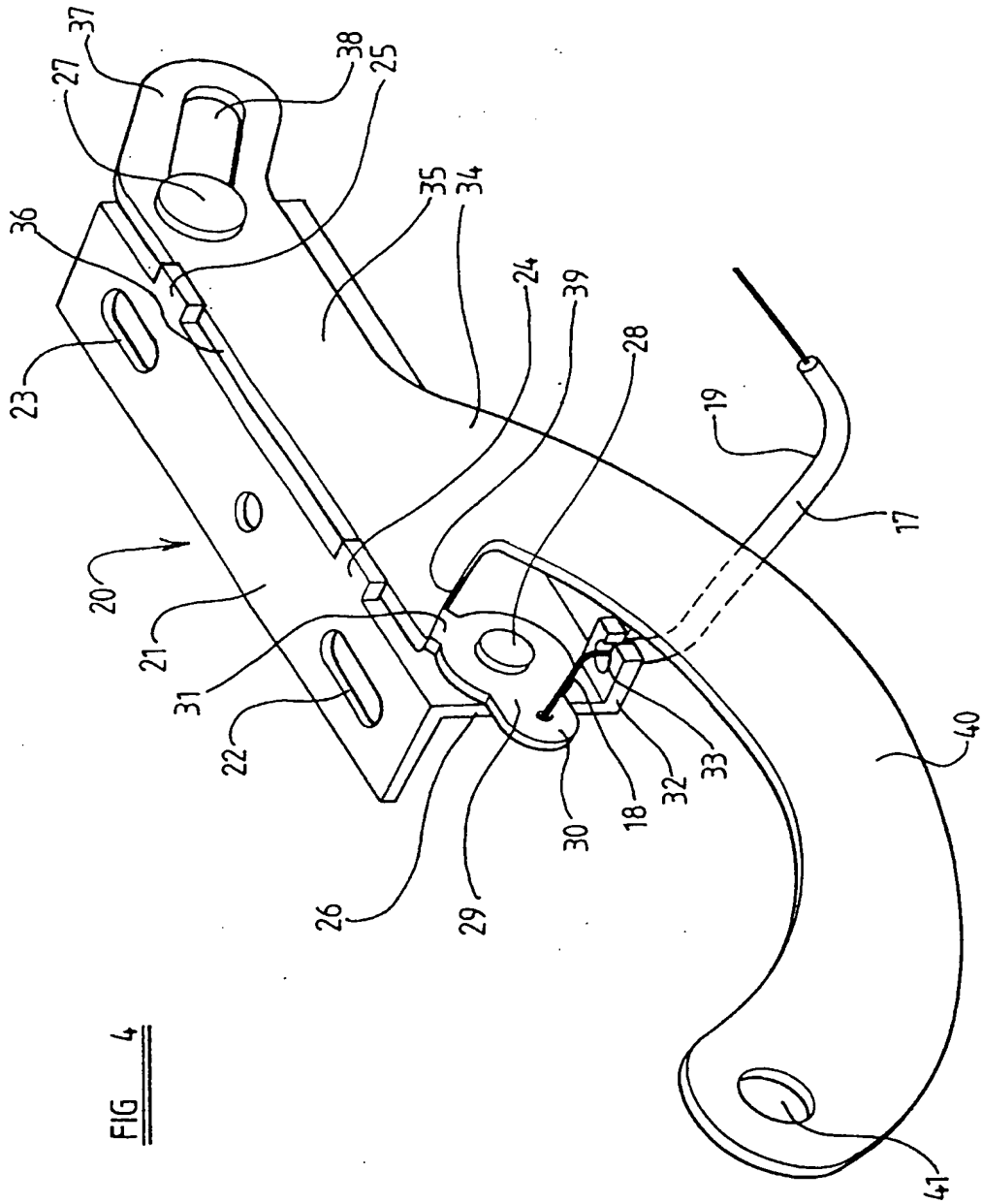


FIG 4

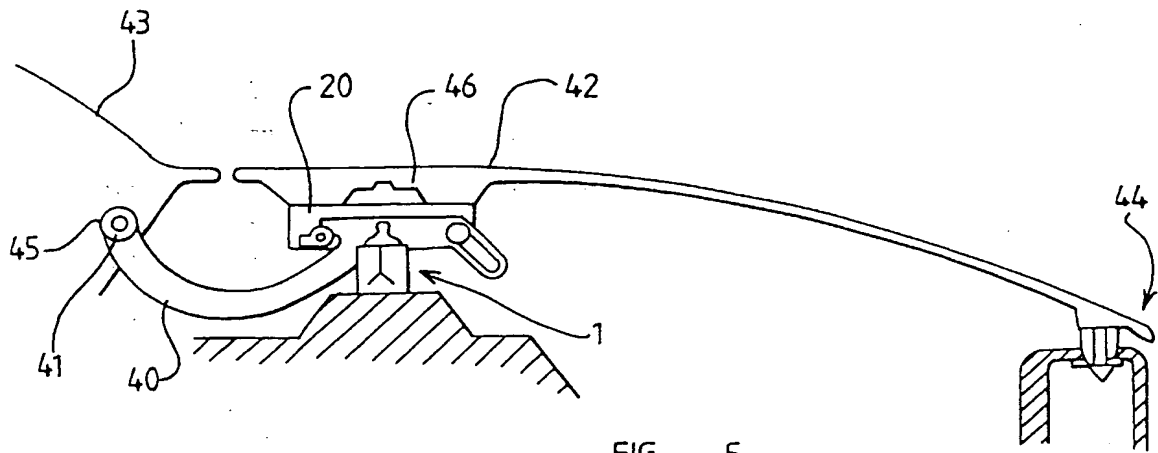


FIG 5

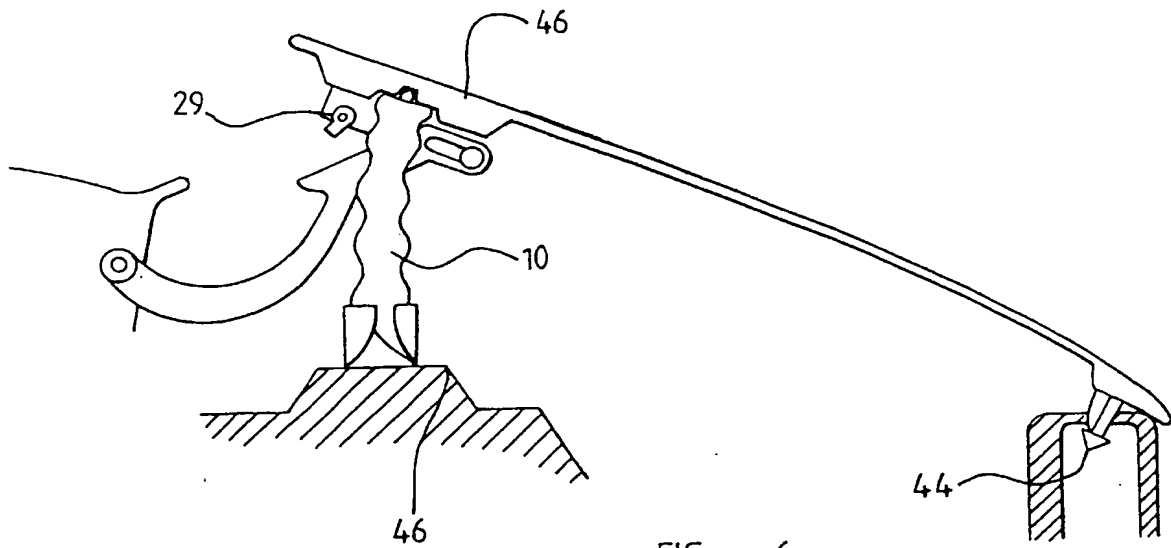


FIG 6

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DESCRIPTION OF INVENTION

**"IMPROVEMENTS IN OR RELATING TO A SAFETY DEVICE"**

**THE PRESENT INVENTION** relates to a safety device, and more particularly relates to a safety device to be mounted on a vehicle to provide protection for a pedestrian struck by the vehicle in an accident situation.

If a pedestrian is struck by a vehicle in an accident situation, the pedestrian may be thrown in such a way that the head or torso of the pedestrian impacts with the hood or bonnet of the motor vehicle. The hood or bonnet of the motor vehicle may deform as a consequence of such impact, but, if the hood or bonnet is closed, the hood or bonnet may only deform by a very short distance before the underside of the hood or bonnet will engage with part of the engine located under the hood or bonnet.

Consequently it has been proposed to provide a mechanism which, in response to the sensing of an impact with a pedestrian, partially raises the hood or bonnet of the vehicle. Thus, when the pedestrian impacts with the hood or bonnet, the hood or bonnet is able to deform over a substantial distance before the underside thereof engages with the engine. During this extensive deformation of the hood or bonnet, the head or torso of the pedestrian may be

decelerated appropriately, relative to the vehicle, without substantial injury arising.

Various arrangements have been proposed to raise part of the bonnet or hood. If such an arrangement is to be located beneath the hood or bonnet, the arrangement must be able to withstand the hot and often oily and greasy environment that is found in a typical engine compartment, without any part of the arrangement deteriorating.

The present invention relates to a safety device of the type intended to lift a hood or bonnet in response to an accident situation involving an impact with a pedestrian.

According to this invention there is provided a safety device for lifting part of the hood or bonnet of a motor vehicle, the safety device comprising a rupturable housing, the rupturable housing sealingly enclosing an inflatable sleeve, the housing being adapted to rupture on inflation of the sleeve to permit the sleeve to emerge from the housing.

Preferably the sleeve is provided with an upper end cap.

Conveniently the upper end cap is provided with a barbed prong adapted to engage a recess or 'socket' provided on a hood or bonnet.

Advantageously the end cap forms the upper part of the housing.

Preferably the cap is provided with a peripheral inclined region, the peripheral inclined region engaging correspondingly inclined under-surface of an inwardly directed lip provided on part of the housing.

Conveniently the housing is provided with one or more lines of weakness to define regions where the housing will rupture on inflation of the inflatable sleeve.

Advantageously two radially outwardly extending projections are provided on opposite sides of a line of weakness, the projections being apertured to receive the core of a Bowden cable, the arrangement being such that the projections will move apart on inflation of the sleeve.

Preferably the inflatable sleeve is formed of fabric.

Conveniently the housing is formed of a plastics material.

In one embodiment of the invention the housing is mounted within a motor vehicle beneath part of the hood or bonnet.

Conveniently the housing is located beneath a rear part of the hood or bonnet, the rear part of the hood or bonnet being hingedly connected to the main part of the vehicle by a hinge arrangement, the hinge arrangement having part thereof initially fast with the hood or bonnet, but provided with a release mechanism to enable the part of the hinge initially fast with the hood or bonnet to effect at least a pivoting motion relative to the hood or bonnet on deployment of the safety device.

Preferably the hinge comprises a hinge arm, one end of which is pivotally connected to said main part of the motor vehicle, the other end of which is associated with a bracket connected to the under-side of the hood or bonnet, the bracket having a stud receivable within an elongate slot formed

within the hinge arm, the bracket having a releasable catch constituting said release mechanism and operable to retain the said part of the hinge arm fast with the bracket, and to release that part of the hinge arm to permit a pivotal movement between that part of the hinge arm and the stud, and to permit movement of the stud along the elongate slot.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a canister containing an inflatable sleeve to form part of a safety device in a motor vehicle,

FIGURE 2 is a sectional view through the upper part of the canister of Figure 1,

FIGURE 3 is a view of the canister of Figure 1 illustrating the canister when the safety device is being deployed,

FIGURE 4 is a perspective view of a hinge structure,

FIGURE 5 is a diagrammatic side view of part of a motor vehicle incorporating a safety device which includes the canister of Figure 1 and the hinge structure of Figure 4 in an ordinary condition, and

FIGURE 6 is a view corresponding to Figure 5 illustrating the safety device in the deployed condition.



Referring initially to Figures 1 to 3, a canister 1 comprises a generally cylindrical housing 2 formed, for example, of a plastics material. The cylindrical housing 2 has at least one line of mechanical weakness 3 formed in the side wall thereof, the preferred arrangement of lines of mechanical weakness comprising three lines of mechanical weakness 3, 4, 5, which have a generally inverted "Y"-shaped configuration, with the line of weakness 3 extending vertically towards the very top of the side-wall of the housing. At the top of the side-wall of the housing, on opposed sides of the line of weakness 3, are radially outwardly protruding apertured lugs 6, 7.

At the upper part of the side-wall of the housing 2, as shown in Figure 2, there is provided an inner rim 8, the inner rim 8 having an inwardly inclined under-surface 9.

Contained within the canister is a fabric sleeve 10. The sleeve 10 is, in the described embodiment, initially folded in a "concertina" manner.

The upper-most part of the sleeve 10, contained within the canister 1, is provided with an upper cap 11. The upper cap 11 has a central planar region 12 which carries an upwardly extending barbed prong 13. Surrounding the planar region 12 is a downwardly inclined peripheral annular region 14, the outer-most peripheral part of which firmly abuts and engages the inclined under-surface 9 of the rim 8 provided on the side-wall of the housing 2. The cap 11 may be secured to the upper part of the fabric sleeve 10 by means of a mounting plate 15 provided within the terminal part of the sleeve 10 which is secured to the cap 11 by means of a screw 16.

A pyrotechnic charge is provided within the canister adapted to inflate the sleeve 10. The lower part of the canister may be provided with a bayonet mounting which can be used to mount the canister in position (as will be described hereinafter) and also to provide electrical contacts to an ignition squib provided within the pyrotechnic charge which is to inflate the sleeve 10.

As shown in Figure 1, a Bowden cable 17 may be associated with the canister. The inner core 18 of the cable will pass through the co-aligned apertures formed in the radially outwardly directed lugs 6 and 7. The sleeve parts 19, 20 of the cable will abut against the exterior parts of the lugs 6 and 7.

It is to be understood that, upon deployment of the safety device, the pyrotechnic charge associated with the sleeve 10 will be ignited, and gas will be injected into the sleeve 10. The sleeve 10 will thus begin to expand. The expansion of the sleeve 10 will cause the housing 2 of the canister 1 to rupture along the lines of mechanical weakness. This rupturing may be assisted by a generally upward force applied to the cap 11 which will cause the inclined peripheral portion 14 of the cap 11 to exert a force on the under-surface 9 of the rim 8 tending to cause the side-walls of the cylindrical housing 2 to distend outwardly, thus splitting the side-wall of the housing 2 along the line of mechanical weakness.

As can be seen in Figure 3, as the fabric sleeve 10 inflates and the cap 11 moves upwardly, so the two radially outwardly directed protrusions 6 and 7 on either side of the split-line 3 move apart which will effectively apply tension to the inner core 18 of the Bowden cable 17.

Turning now to Figure 4, a hinge assembly is illustrated, and it is to be understood that two hinge assemblies of this type will be used to mount the

hood or bonnet of a motor vehicle in position, and each will be associated with a canister 1 as described above.

The hinge assembly comprises a mounting bracket 20 which incorporates a rectangular planar plate 21 provided with two spaced-apart mounting apertures 22, 23. The planar plate is adapted to be mounted to the under-side of a hood or bonnet by screws or the like passing through the two mounting apertures 22, 23. At one of the long side edges of the planar plate 21, there are two outwardly extending lugs 24, 25. The lugs 24, 25 extend above and protrude beyond a depending wall 26 which depends from the said long side edge. A "T"-headed stud 27 extends perpendicularly from the depending wall 26 adjacent one end thereof, and a pivot 28 extends perpendicularly from the wall 26 adjacent the other end thereof. The pivot 28 pivotally supports a rotatable catch element 29 which forms part of a release mechanism. The catch element 29 has a first radially extending arm 30 and a second radially extending retainer arm 31. The first arm 30 is connected to the core 18 of the Bowden cable 17. The retainer arm 31 serves to retain part of hinge assembly in position, as will be described below.

Beneath the catch 30 is a horizontally protruding lug 32 which extends horizontally from the lower edge of the depending wall 26. The lug 32 is provided with a recess 33 in one side edge thereof. The recess 33 is dimensioned so that the core 18 of the Bowden cable may pass through the recess, whilst the sleeve 19 of the Bowden cable engages the lug adjacent the recess. Tension applied to the core 18 of the Bowden cable will cause the catch 29 to rotate.

A hinge arm 34 is provided, the hinge arm having a first linear portion 35 which lies adjacent the depending plate 21. A substantially linear or

straight upper edge 36 of the linear 35 engages the under-surface of each of the lugs 24, 25. At one end of the linear part 35 there is an inclined extension 37 of the hinge arm, the extension 37 having an oval slot 38 therein. The "T"-headed stud 27 passes through the slot 38. The stem of the stud is dimensioned to slide along the slot.

At the other end of the linear part 35 of the hinge arm 34, there is an inclined end surface 39 which is engaged by the retaining arm on the catch element 29. The arrangement is such that, with the catch element 29 in a latching position, as shown in Figure 4, the end face of the retaining arm 31 engages the inclined end face 39 of the linear portion 35 of the hinge arm 34, and consequently the hinge arm 34 is retained fast with the mounting bracket 20. However, if the catch element 29 is rotated in an anti-clockwise manner by tension applied to the core 18 of the Bowden cable 17, then the hinge arm 34 is released and may move relative to the bracket 20 whilst being restrained by the engagement between the "T"-headed stud 27 and the slot 38.

The linear portion 35 of the hinge arm 34 is connected to an elongate arcuate portion 40 of the hinge arm which terminates with a mounting aperture 41.

Referring now to Figure 5, part of a motor vehicle is illustrated. Figure 5 shows the hood or bonnet 42 of the motor vehicle, which is mounted in position in front of the windscreen or windshield 43. The forward-most end of the hood or bonnet is provided with a releasable catch 44, of conventional design, to release the hood or bonnet to provide access to the engine space beneath the hood or bonnet. Towards the rear of the hood or bonnet, the mounting plate 20 of a hinge assembly, as shown in Figure 4 is mounted to the under-side of the hood or bonnet, and the arcuate portion 40 of the hinge

arm 40 is connected, by means of the aperture 41, to a pivotal mounting point 45 located on the main part of the motor vehicle adjacent the base of the windscreen 43. Two hinge assemblies will be provided, one on each side of the vehicle. A recess or 'socket' 46 is provided on the underside of the hood or bonnet above the canister 1 to receive the barbed prong 13 when the safety device is deployed.

The free end of the Bowden cable 17 may be connected to an actuating lever provided on the interior of the motor vehicle or, alternatively, may be mounted to a fixed point.

A canister 1, as described above, is mounted in position beneath part of the hood or bonnet adjacent the horizontal plate 21 of each bracket 20, being mounted in position appropriately, for example, by the described bayonet connection, on a firm or immovable part 46 of the motor vehicle. Thus there is a respective canister 1 on each side of the vehicle. The barbed prong 13 is located beneath the recess or 'socket' 46. The hood or bonnet may be opened in the normal way by releasing a conventional catch 44 provided at the front of the hood or bonnet 42, and then lifting the forward-most edge of the hood or bonnet. The hood or bonnet will pivot about the pivotal mounting 45. The linear portion 35 of the hinge arm 34 will remain fast with the bracket 20, because it will be retained in this condition by a combination of the "T"-headed stud 27 at one end of the elongate slot 38, and the retaining arm 31 of the catch 29.

In the event that an accident should occur involving an impact with a pedestrian, the safety device will be deployed. As described above, each housing 2 will rupture, permitting the sleeve 10 to expand. The cap 11 will move upwardly and the barbed prong 13 present on the cap 12 will move

upwardly and engage the recess or 'socket 46', and the action of the barbed prong 13 will prevent the end cap 14 from subsequently becoming disengaged from the recess or 'socket' 46. As the housing 2 ruptures, so tension will be applied to the Bowden cable which will serve to rotate the catch 29 to a position in which the radial arm 31 no longer has the end face thereof engaging the end wall 39 of the linear portion 35 of the hinge arm 34, thus effectively releasing the linear part 35 of the hinge arm, permitting the hinge arm to rotate, relative to the bracket 20, about the axis defined by the "T"-headed stud 27.

As the sleeves 10 continues to inflate, the sleeves 10 will extend upwardly, thus forcing the rearward part of the hood or bonnet upwardly. The hood or bonnet will then pivot about the conventional catch 44 provided at the front of the hood or bonnet. As the rear part of the hood or bonnet moves upwardly, so the hinge arm 34 of each hinge will pivot about the pivot axis 45, and the "T"-headed stud 27 will slide along the elongate slot 38. When the "T"-headed stud 27 reaches the other end of the elongate slot 38, further upward movement of the hood or bonnet will be prevented.

In the described embodiment of the invention, the sleeve 10 is formed of a fabric material. The fabric material may be utilised because the canister 1 is initially substantially sealed to sealingly enclose the sleeve. This will prevent the ingress of any oil or dirt, which might cause deterioration of the fabric of the sleeve.

Whilst the invention has been described with reference to one embodiment, it is to be appreciated that many modifications may be effected. The canister, as described, is fabricated of a plastics material, but is to be appreciated that the canister could be manufactured from an appropriate metal. Whilst one form of canister has been illustrated, the canister may be of many

different designs. The canister may complete encapsulate the combination of the inflatable sleeve and the end cap of the sleeve, although it is preferred that, effectively, the end cap of the sleeve should form the end cap of the canister, since this minimises the use of raw material.

In a further modified embodiment of the invention, the canister is constituted by a combination of the top cap, a base plate and an annular ring which serves sealingly to interconnect the top cap and the base plate, whilst sealing the inflatable sleeve within the canister. The annular ring may be provided with a line of mechanical weakness and be formed of a material such as plastics or metal, or, alternatively, the ring may be formed of a frangible material adapted simply to break in response to inflation of the sleeve.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

## CLAIMS:

1. A safety device for lifting part of the hood or bonnet of a motor vehicle, the safety device comprising a rupturable housing, the rupturable housing sealingly enclosing an inflatable sleeve, the housing being adapted to rupture on inflation of the sleeve to permit the sleeve to emerge from the housing.
2. A device according to Claim 1 wherein the sleeve is provided with an upper end cap.
3. A device according to Claim 2 wherein the upper end cap is provided with a barbed prong adapted to engage a recess or 'socket' provided on a hood or bonnet.
4. A device according to Claim 2 or 3 wherein the end cap forms the upper part of the housing.
5. A device according to Claim 4 wherein the cap is provided with a peripheral inclined region, the peripheral inclined region engaging correspondingly inclined under-surface of an inwardly directed lip provided on part of the housing.
6. A device according to any one of the preceding Claims wherein the canister is provided with one or more lines of weakness to define regions where the canister will rupture on inflation of the inflatable sleeve.



7. A canister according to Claim 6 wherein two radially outwardly extending projections are provided on opposite sides of a line of weakness, the projections being apertured to receive the core of a Bowden cable, the arrangement being such that the projections will move apart on inflation of the sleeve.
8. A safety device according to any one of the preceding Claims wherein the inflatable sleeve is formed of fabric.
9. A safety device according to any one of the preceding Claims wherein the housing is formed of a plastics material.
10. A safety device according to any one of the preceding Claims wherein the housing is mounted within a motor vehicle beneath part of the hood or bonnet.
11. A safety device according to Claim 10 wherein the housing is located beneath a rear part of the hood or bonnet, the rear part of the hood or bonnet being hingedly connected to the main part of the vehicle by a hinge arrangement, the hinge arrangement having part thereof initially fast with the hood or bonnet, but provided with a release mechanism to enable the part of the hinge initially fast with the hood or bonnet to effect at least pivoting motion relative to the hood or bonnet on deployment of the safety device.
12. A safety device according to Claim 11 wherein the hinge comprises a hinge arm, one end of which is pivotally connected to said main part of the motor vehicle, the other end of which is associated with a bracket connected to the under-side of the hood or bonnet, the bracket having a stud receivable within an elongate slot formed within the hinge arm, the bracket having a

releasable catch constituting said release mechanism and operable to retain the said part of the hinge arm fast with the bracket, and to release that part of the hinge arm to permit a pivotal movement between that part of the hinge arm and the stud, and to permit movement of the stud along the elongate slot.

13. A safety device substantially as herein described with reference to and as shown in the accompanying drawings.

14. Any novel feature or combination of features disclosed herein.



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Application No: GB 0208799.7  
Claims searched: 1 - 13

Examiner: Beverley Lloyd  
Date of search: 9 August 2002

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B7B (BSBNC)

Int Cl (Ed.7): B60R 21/34; B62D 25/10, /12

Other: Online: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2344080 A (TEMPLE) See Fig 6; lines 11 - 15, page 14	-
X	EP 0967128 A2 (NISSAN) See Figs 5 - 7; line 50, col 6 - line 16, col 8; lines 38 - 43, col 8	1, 10 - 12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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